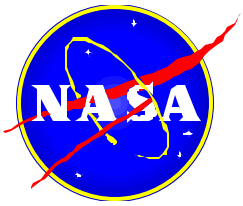

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas 77058

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Interface Definition Document for the Human Research Facility (HRF) Total Force Foot Ground Interface (TF-FGI)

LS-71032-6

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DOCUMENT NUMBER	DATE	NO. OF PAGES
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for the
Human Research Facility (HRF)
Total Force Foot Ground Interface (TF-FGI)

APPROVED:	EA5/Albert Rodriguez Technical Manager	Signature on File

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Report Number	LS-71032-6	**Date**	12/14/00

Interface Definition Document
for the
Human Research Facility (HRF)
Total Force Foot Ground Interface (TF-FGI)

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Altered pages must be typed and distributed for insertion.

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ACRONYMS AND ABBREVIATIONS

ADAS	Ambulatory Data Acquisition System
FCU	Flight Calibration Unit
HRF	Human Research Facility
IDD	Interface Definition Document
ISS	International Space Station
LEMS	Lower Extremity Monitoring Suit
P/N	Part Number
PWA	Printed Wiring Assembly
RTV	Room Temperature Vulcanization
TF-FGI	Total Force Foot Ground Interface
V	Volts

1.0 INTRODUCTION

1.1 PURPOSE

This Interface Definition Document (IDD) defines the interfaces provided by the Human Research Facility (HRF) Total Force Foot Ground Interface (TF-FGI), P/N SEG46118238-301.

1.2 SCOPE

The TF-FGI interfaces to be defined include: Mechanical, Electrical, Data, Audio/Video, Thermal, Vacuum and Nitrogen. No attempt has been made to define the Human Factors user interfaces or software interfaces; those tasks are out of the scope of this document.

2.0 APPLICABLE DOCUMENTS

Document Number	Rev.	Document Title
LS-71032-4	Draft	System Requirements Document for the Human Research Facility Total Force Foot Ground Interface.
LS-71032-3	Draft	System Requirements Document for the Human Research Facility Foot Ground Interface Flight Calibration Unit.

3.0 HARDWARE DESCRIPTION

The TF-FGI is a human instrumentation system component of the HRF on board the International Space Station (ISS). The TF-FGI will provide a primary means to dynamically measure the total force exerted on each foot by the crewmembers during normal work, training and exercise routines. The hardware will be crew-worn and will interface with other HRF hardware items.

The TF-FGI consists of the following components:

A. TF-FGI Box

The TF-FGI Box (P/N SEG46118240-301) consists of a Printed Wiring Assembly (PWA) contained within an aluminum housing. All components, other than external batteries are contained on the single PWA. Common alkaline nine-volt batteries provide a minimum lifetime of twelve hours of operation.

The TF-FGI PWA is an analog signal conditioning circuit. It interfaces with the Novel insoles, which are used as the sensor, and with the HRF Ambulatory Data Acquisition System (ADAS), which acts as the data acquisition and storage unit.

The TF-FGI PWA incorporates semi-automatic calibration of the individual insoles, through the use of an on board microcontroller. A diagram of the TF-FGI Box is shown in Figure 3-1.

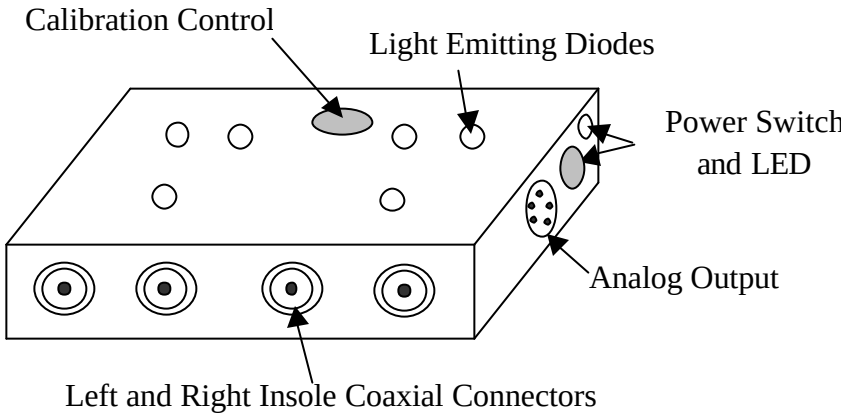

Figure 3-1. TF-FGI Box Diagram

B. TF-FGI Insole Assembly

The TF-FGI Insole Assembly (P/N SEG46118241-301) consists of a pair of Novel insoles (left and right, P/N SEG33110422-001 through –022, depending on crewmember size). The Novel insole connectors are embedded in a Silicone Room Temperature Vulcanization (RTV) molding to prevent disconnection. Two external electrical connectors are used per insole. The connectors interface with cables in the Lower Extremity Monitoring Suit (LEMS). Each insole consists of 99 individual capacitive pressure sensors distributed over the entire insole surface area. Compression of the insole surface varies the output signal, which is transferred to the TF-FGI Box via a cable in the LEMS or other coaxial cable.

A diagram of the TF-FGI Insole Assembly is shown in Figure 3-2.

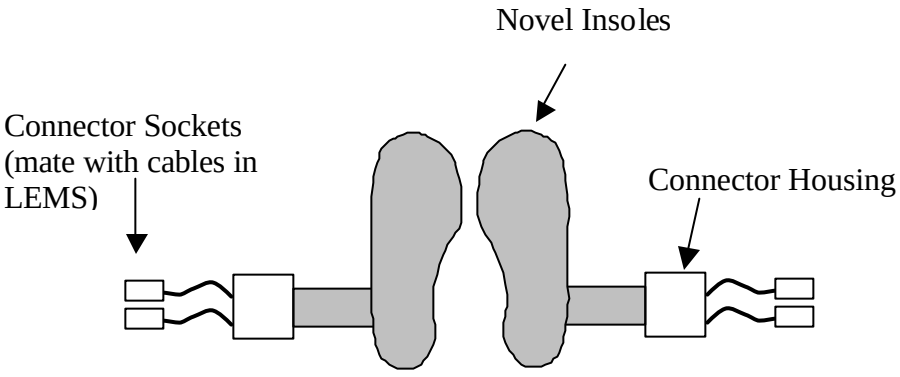

Figure 3-2. TF-FGI Insole Assembly Diagram

4.0 TOTAL FORCE FOOT GROUND INTERFACE INTERFACES

4.1 MECHANICAL INTERFACES

The TF-FGI will be stowed for launch and landing. It will interface with the FGI Flight Calibration Unit (FCU) for calibration. Each insole will be inserted in the FGI FCU and calibrated individually. The LEMS shall provide structural support for the TF-FGI box during use. The TF-FGI insole assembly shall be crew-worn, with the insoles being inserted in the crewmembers' shoes.

4.2 ELECTRICAL INTERFACES

The TF-FGI is battery powered and has no electrical power interfaces to other equipment.

4.2.1 Total Force Foot Ground Interface Box Sensor Interfaces

The TF-FGI Box sensor interfaces (J1-J4) are four Fischer coaxial receptacles for Printed Circuit Boards, P/N DLP 101 A004-40. The mate to these connectors are Fischer plug style connectors, P/N WS 101 A004 or similar. Black and white insulating washers are used for color-coding purposes.

The TF-FGI box interfaces are as follows:

TABLE 4.2.1-1. TF-FGI BOX INTERFACES

(J1-J4) TF-FGI Box Sensor Interfaces P/N: DLP 101 A004-40 Mate: WS 101 A004		
Connector	Function	Color Coding
J1	Left Sensor Input	Black
J2	Right Sensor Input	Black
J3	Right Excitation	White
J4	Left Excitation	White

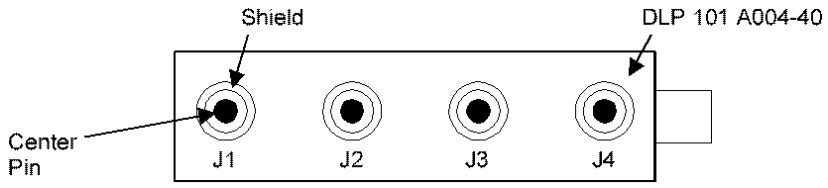

Figure 4.2.1-2. TF-FGI Box Sensor Interfaces (Right Side View)

4.2.2 Total Force Foot Ground Interface Box Analog Output

The TF-FGI box analog output (J5) is a 5-pin Lemo connector (P/N EEG 0B 305 CLV). The mate to this connector is a plug style Lemo connector (P/N FGG.0B.305.CLAD42Z or similar).

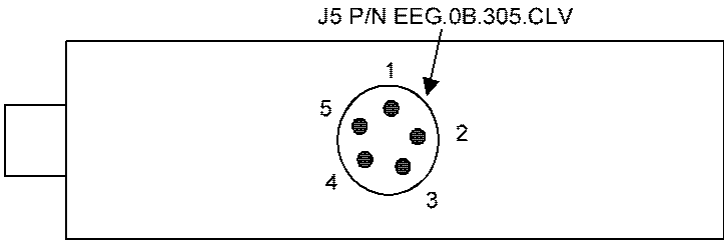

Figure 4.2.2-1. TF-FGI Box Analog Output (Top View)

TABLE 4.2.2-2. PIN ASSIGNMENTS FOR THE TF-FGI ANALOG OUTPUT

(J5) TF-FGI Analog Output: P/N: EEG.0B.305.CLV Mate: P/N FGG.0B.305.CLAD42Z	
Pin Number	Function
1	Ground
2	Right Output Impedance 100 ohms Level –25mV to 50mV
3	Ground
4	Ground
5	Left Output Impedance 100 ohms Level –25mV to 50mV

4.2.3 Total Force Foot Ground Interface Insole Assembly Interfaces

The connectors on each insole are Fischer coaxial cable receptacles, P/N K101 A004-2. The mate to this connector is a Fischer plug style connector (P/N S101 A004-2 or similar). Black and white strain reliefs are used for color-coding purposes.

TABLE 4.2.3-1. TF-FGI INSOLE CONNECTOR INTERFACES

(J1-J4) TF-FGI Insole Assembly Sensor Interfaces P/N: K101 A004-2 Mate: S101 A004-2		
Connector	Function	Color-Coding
J1	Left Sensor Output	Black
J2	Left Sensor Input (Excitation)	White
J3	Right Sensor Output	Black
J4	Right Sensor Input (Excitation)	White

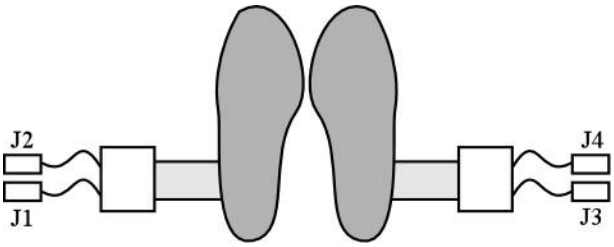

Figure 4.2.3-2. TF-FGI Insole Assembly Interfaces

4.3 DATA INTERFACES

The TF-FGI has no external data interfaces. An internal interface is provided to allow reprogramming of the TF-FGI firmware on the ground if required. This interface consists of a 10-pin header (Digi-Key P/N S2111-5-ND), which is mounted on the PWA within the TF-FGI Box, and can be connected to a computer via an EPIC programmer.

4.4 AUDIO/VIDEO INTERFACES

Not applicable. The TF-FGI contains no audio or video interfaces.

4.5 THERMAL INTERFACES

The TF-FGI shall be cooled by convection of the cabin air.

4.6 VACUUM INTERFACES

Not applicable. The TF-FGI has no vacuum interfaces.

4.7 NITROGEN INTERFACES

Not applicable. The TF-FGI has no nitrogen interfaces.

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